

CLAIMS

1. An air bag system comprising:

an inflator operable to release gas;

5 an inflatable air bag having releasable tether elements connected thereto, wherein said air bag is inflatable upon release of gas from said inflator;

10 a housing substantially surrounding said inflator and said air bag prior to inflation thereof, wherein the housing is formed with a first vent therein for venting gas released by said inflator;

15 a tether release/vent-modifying mechanism operatively connected to said housing, wherein said tether release/vent-modifying mechanism has a plurality of walls and a movable member, wherein the movable member has a cap portion and a generally elongated rod portion extending longitudinally from an underside of said cap portion, wherein a first broad portion extends from said cap portion forward of said underside, wherein said plurality of walls and said cap portion cooperate to partially form a pressurizable chamber;

20 wherein said tether release/vent-modifying mechanism further includes an actuator operable to selectively emit gas into said pressurizable chamber for moving said movable member from a first position to a second position, said actuator further defining said pressurizable chamber;

25 wherein said tether elements are restrained by said rod portion when said movable member is in the first position, thereby restricting inflation of said air bag by said inflator to a first profile, wherein said tether elements are released from said rod

portion when said movable member moves to said second position, thereby permitting inflation of said air bag by said inflator to a second profile;

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wherein said first broad portion covers said vent when said movable member is in one of said first position and said second position, and wherein said first broad portion uncovers said vent when said movable member is in the other of said first position and said second position.

2. The air bag system of claim 1, wherein said first broad portion includes an inflation gas reaction surface and a vent-covering portion, wherein said inflation gas reaction surface pushes against said gas released from said inflator, and wherein said cap portion pushes said vent-covering portion and pulls said rod portion 5 when said movable member moves from said first position to said second position.

3. The air bag system of claim 1, wherein said cap portion includes a deformably expandable forward end, wherein said broad portion is retainably connectable to said cap portion to extend therefrom by deformably expanding said expandable forward end.

4. The air bag system of claim 1, wherein said tether release/vent-modifying mechanism is operatively connected to said housing at a first portion of said housing and said inflator mounts to said housing at a second portion of said housing such that said tether release/vent-modifying mechanism and said inflator are not mounted to 5 one another.

5. The air bag system of claim 1, further comprising:

an air bag retainer mountable to said housing for retaining said air bag to said housing upon inflation of said air bag, wherein said tether release/vent-modifying

- 5 mechanism is mountable to said air bag retainer and is thereby operatively connected to said housing via said air bag retainer when said air bag retainer is mounted to said housing.

6. The air bag system of claim 1, wherein said tether release/vent-modifying mechanism further includes a floor, wherein said floor is matable with said plurality of walls, wherein said floor is formed with an electrical connector opening, wherein said electrical connector opening abuts said actuator when said floor and said 5 plurality of walls are mated, wherein said electrical connector opening is configured to receive an electrical connector connectable to said actuator, wherein said floor is further formed with a channel leading to said electrical connector opening, wherein said channel is adapted to receive wiring, and wherein said wiring may be routed to said electrical connector along said channel.

7. The air bag system of claim 1, wherein said tether release/vent-modifying mechanism further includes a floor, wherein said floor is matable with said plurality of walls, wherein said floor further includes an integral retention pin wherein said plurality of walls is formed with a pin opening sized to release said retention pin, 5 wherein when said floor and said plurality of walls are mated, said integral retention pin extends from said floor through said pin opening towards said movable member to abut said movable member and thereby retain said movable member in said first position prior to emission of gas by said actuator, and wherein said retention pin is sheared by said movable member when said movable member moves to said second position.

8. The air bag system of claim 1, wherein said tether release/vent-modifying mechanism further includes a floor, wherein said floor is matable with said plurality of walls, wherein one of said floor and said first broad portion is formed with a releasably retainable engaging member, wherein the other of said floor and said first 5 broad portion forms an engaging opening sized to receive said engaging member,

wherein said engaging member is retained at said engaging member opening when said movable member is in said first position, and released after emission of gas by said actuator to permit said movable member to move to said second position.

9. The air bag system of claim 1, wherein said first broad portion is releaseably retained by said plurality of walls when the movable member is in said first position and released from said plurality of walls to permit said movable member to move to said second position after emission of gas by said actuator.

10. The air bag system of claim 9, wherein said first broad portion further includes spring-biased arms, wherein said spring-biased arms extend from said first broad portion toward said plurality of walls and are biased to so releasably retain said first broad portion at said plurality of walls when the movable member is in said first 5 position, and wherein said spring-biased arms flex such that said first broad portion is so released from said plurality of walls after emission of gas by said actuator to permit said movable member to move to said second position.

11. The air bag system of claim 9, wherein one of said first broad portions and said plurality of walls is formed with a releasably retainable engaging member and the other of said first broad portion and said plurality of walls forms an engaging member opening sized to receive and releasably engage with said engaging member such that the engaging member is engaged at said engaging member opening, said first broad portion thereby being releasably retained at said plurality of walls when the movable member is in said first position, and wherein the engaging member is released after said emission of gas by said actuator, thereby permitting said movable member to move to said second position.

12. The air bag system of claim 1, further comprising a forked stopping element having tines, wherein said plurality of walls form tine openings sized to

receive said tines, wherein said tines are operable to stop movement of said movable member at said second position when said tines are so received.

13. The air bag system of claim 12, wherein said forked stopping element includes a releasably retainable engaging member, wherein said first broad portion includes an engaging member opening sized to releasably engage said engaging member, wherein said engaging member is engaged at said engaging member opening when said movable member is in said first position, and wherein said engaging member is released after said emission of gas by said actuator, thereby permitting said movable member to move to said second position.

14. A vehicle having an air bag system for impact restraint, comprising:

a vehicle body at least partially defining an interior space therein;
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an air bag system comprising an inflatable air bag having releasable tether elements connected thereto, wherein said air bag is inflatable upon release of gas from an inflator to deploy into said interior space;

10 said passenger air bag system further comprising a housing substantially surrounding said inflator and said air bag prior to inflation thereof, wherein the housing is formed with a first vent therein for venting gas released by said inflator;

15 said passenger air bag system comprising a tether release/vent-modifying mechanism operatively connected to said housing, wherein said tether release/vent-modifying mechanism has a plurality of walls and a movable member, wherein the movable member has a cap portion and a rod portion extending from an underside of said cap portion, wherein a first broad portion extends from said cap portion, wherein said

20 plurality of walls and said cap portion cooperate to at least partially form a pressurizable
chamber;

25 wherein said tether release/vent-modifying mechanism further includes an
actuator operable to selectively emit gas into said pressurizable chamber for moving said
movable member from a first position to a second position, said actuator further defining
said pressurizable chamber;

30 wherein said tether elements are restrained by said rod portion when said
movable member is in the first position, thereby restricting inflation of said air bag by
said inflator to a first profile, wherein said tether elements are released from said rod
portion when said movable member moves to said second position, thereby permitting
inflation of said air bag by said inflator to a second profile;

35 wherein said first broad portion covers said vent when said movable
member is in one of said first position and said second position, and wherein said first
broad portion uncovers said vent when said movable member is in the other of said first
position and said second position.

15. The vehicle of claim 14, wherein said first broad portion includes
an inflation gas reaction surface and a vent-covering portion, wherein said inflation gas
reaction surface pushes against said gas released from said inflator, and wherein said cap
portion pushes said vent-covering portion and pulls said rod portion when said movable
5 member moves from said first position to said second position.

16. The vehicle of claim 14, further comprising:

an air bag retainer mountable to said housing for retaining said air bag to said housing upon inflation of said air bag, wherein said tether release/vent-modifying mechanism is mountable to said air bag retainer and is thereby operatively connectable to said housing via said air bag retainer when said air bag retainer is mounted to said housing.

17. The vehicle of claim 14, wherein said tether release/vent-modifying mechanism further includes a floor, wherein said floor is matable with said plurality of walls, wherein said floor is formed with an electrical connector opening, wherein said electrical connector opening abuts said actuator when said floor and said plurality of walls are mated, wherein said electrical connector opening is configured to receive an electrical connector connectable to said actuator, wherein said floor is further formed with a channel leading to said electrical connector opening, wherein said channel is adapted to receive wiring, wherein said wiring may be routed to said electrical connector along said channel;

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wherein said floor further includes an integral retention pin wherein said plurality of walls is formed with a pin opening sized to receive said retention pin, wherein when said floor and said plurality of walls are mated, said integral retention pin extends from said floor through said pin opening towards said movable member to abut said movable member and thereby retain said movable member in said first position prior to emission of gas by said actuator, and wherein said retention pin is sheared by said movable member when said movable member moves to said second position.

18. A tether release/vent-modifying mechanism for an air bag system, the tether release/vent-modifying mechanism comprising:

a plurality of walls;

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a movable member having a cap portion and a generally elongated rod portion extending longitudinally from an underside of said cap portion, wherein a first broad portion extends from said cap portion forward of said underside, wherein said plurality of walls and said cap portion cooperate to at least partially form a pressurizable chamber;

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an actuator operable to selectively emit gas into said pressurizable chamber for moving said movable member from a first position to a second position, said actuator further forming said pressurizable chamber;

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wherein said rod portion is operable to restrain tether elements attached to an inflatable air bag when said movable member is in said first position and to release said tether elements when said movable member moves to said second position, said air bag being inflatable to a first profile when said tether elements are so restrained and to a second profile when said tether elements are so released; and

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wherein said first broad portion is operable for covering or uncovering an adjacent vent formed in an air bag housing when said movable member moves from said first position to said second position.

19. A method of assembling an air bag system, wherein the air bag system includes an inflatable air bag having releasably restrainable tether elements attached thereto, a tether release/vent-modifying mechanism for releasably restraining said tether elements, said air bag being inflatable by an inflator to a first profile when said tether elements are restrained and to a second profile when said tether elements are released, and an air bag retainer for retaining said air bag to a module housing upon inflation of said air bag, the method comprising:

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securing said tether release/vent-modifying mechanism to said air bag

10 retainer;

connecting said air bag to said air bag retainer;

restraining said tether elements at said movable member;

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after said securing step, attaching said air bag retainer to said module housing such that said air bag is retained by said housing upon inflation of said air bag; and

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attaching said inflator to said module housing.

20. The method of claim 19, further comprising:

mounting said module housing to a vehicle.